

**CGMS HIGH LEVEL PRIORITY PLAN (HLPP)  
2015 - 2019**

**1. INTRODUCTION**

The main goals of the coordination activities of the Coordination Group for Meteorological Satellites are to support operational weather monitoring and forecasting as well as climate monitoring, in response to requirements formulated by WMO, its programmes and other programmes jointly supported by WMO and other international agencies.

It is the policy of CGMS to coordinate satellite systems of its members in an end-to-end perspective, including protection of in orbit assets and support to users - e.g. through appropriate training - as required to facilitate and develop shared access to and use of satellite data and products in various applications. This policy reflects in the structure of this 5-year High Level Priority Plan, which covers:

1. Coordination of observing systems and protection of assets
2. Coordination of data access , contributions to the WMO Information System
3. Enhance the quality of satellite-derived data and Products
4. Outreach and training activities
5. Cross-cutting issues and new challenges

This rolling 5-year plan is seen as part of a longer-term perspective, in particular as regards the new challenges raised by climate monitoring in the context of the implementation of the Global Framework for Climate Services approved by the Extraordinary Congress of WMO on 31 October 2012.

CGMS reviews the HLPP on an annual basis, considering in particular new requirements and perspectives arising from interactions with the user and scientific communities, the development of applications, e.g. NWP, and relevant research activities. It ensures proper interaction with other space agencies and their relevant constituencies (e.g. CEOS including its working groups and virtual constellations).

## **HIGH LEVEL PRIORITY TASKS**

The high level priority tasks are presented according to the logic of the CGMS end-to-end systems

## 1 COORDINATION OF OBSERVING SYSTEMS AND PROTECTION OF ASSETS

### 1.1 Coordination of observing systems



1.1.1 Advance the implementation of the CGMS baseline missions (updated nominal locations/orbits, operators), in particular the constellation of three polar Low Earth orbit planes (early morning, mid-morning, and afternoon), each with full sounding capabilities (infrared and microwave).

1.1.2 Support satellite impact studies including regional verification;



1.1.3 Facilitate the evolution of research short-term missions to an operational status (where appropriate e.g. HEO missions);



1.1.4 Investigate through IROWG how a coordinated and optimised system could be set up for radio occultation observations for atmosphere and ionosphere monitoring;

1.1.5 Identifying partnership opportunities on space and ground segments and establish CGMS coordinated mechanisms for hosted payloads, e.g. for solar wind monitoring;

1.1.6 Identify potential gaps and ensure appropriate contingency measures are in place including analysis of budget constraints and associated risk assessment. For Ocean-relevant missions, these measures should be defined in close dialogue with the CEOS Virtual Constellations for oceans.

### 1.2 Coordination/Optimisation of data collection systems

1.2.1 Coordinated participation in the activities of the International Forum of Users of Satellite Data Telecommunication Systems, to prepare the future use of the International Data Collection System (IDCS);

1.2.2 Assess Data Collection Platform (DCP) and Argos Data Collection System (A-DCS) status and evolutions including International channels, taking into account requirements of tsunami alert systems and in-situ ocean observations (e.g. buoys);

1.2.3 Share lessons learnt and share experiences on certification of DCS platforms (especially High Rate DCPs);

1.2.4 Share information on the development of their High Rate DCPs and share lessons learned on mitigating interference between DCPs;

1.2.5 To confirm user requirements for sharing data/information delivered using DCS (outside the regional area). Evolve the mechanisms to share DCP data.

### 1.3 Radio Frequency (RF) Protection

- 1.3.1 Establish a coordinated position on the future of L-band services;
- 1.3.2 Investigate how to mitigate Earth Exploration Satellite Service (EESS) X-band (8025 – 8400 MHz) congestion and coordinate interference assessments on a regular basis and, as necessary, establish inter-agency coordination mechanisms to facilitate sharing and use of this frequency band by LEO and GEO systems;
- 1.3.3 Investigate how to mitigate MetSats X-band (7750 – 7900 MHz) congestion and coordinate interference assessments on a regular basis and, as necessary, establish inter-agency coordination mechanisms to facilitate sharing and use of this frequency band by LEO and GEO systems;
- 1.3.4 Facilitate an effective preparation of national positions for the World Radio-communication Conference (WRC) favorable for the CGMS-related issues, including the protection of sensing frequencies in C-band.

### 1.4 Coordination of Direct Readout Systems and Regional Retransmission Services



- 1.4.1 Evaluate the set of applicable (or TBD) standards for dissemination mechanisms in use by CGMS members and assess if there is a need, in view of future systems, to amend, modify or revise such standards (or to derive new ones);
- 1.4.2 Facilitate the transition to new direct readout systems (GOES-R, JPSS, FY-3, Meteor-M);
- 1.4.3 Work together to define a set of recommendations seeking affordable future receiving stations or alternatives to direct read-out solutions;
- 1.4.4 Provide level-1 processing software packages, consistent with global processing software, for processing of Direct Broadcast data from the new generation of LEO satellites.
- 1.4.5 Further enhance the Regional ATOVS Retransmission Services (RARS) initiatives through inclusion of the NOAA Direct Broadcast Real Time Network (DBRTN) and an extension to advanced sounders for at least half of the globe.

- 2 COORDINATION OF DATA ACCESS AND CONTRIBUTION TO THE WMO INFORMATION SYSTEM (WIS)
  - 2.1 Support the user-provider dialogue on regional/continental scales through regional coordination groups maintaining requirements for dissemination of satellite data and products through the various broadcast services;
  - 2.2 Support the implementation of sustained, coordinated Digital Video Broadcast (DVB) satellite services for the Americas, Africa, Europe and the Asia Pacific regions;
  - 2.3 Increase access to, and use of, data from R&D and pre-operational missions;
  - 2.4 Investigate the feasibility of introducing a coordinated dissemination service for meteorological information in helping to mitigate disasters;
  - 2.5 Investigate the feasibility of introducing a coordinated dissemination service for information in support of the ocean user community;
  - 2.6 Develop efficient standardized data handling for high-resolution imaging and hyper-spectral instruments, employing novel methods like dissemination of hyperspectral infrared data based on Principal Component Analysis.
  - 2.7 Utilise operationally the WIS infrastructure for satellite data provision and discovery;
  - 2.8 Provide coordinated CGMS inputs to WMO on satellite and instrument identifiers or data representation and metadata within the WIS (including the Regional Meteorological Data Communications Network).

### 3 ENHANCE THE QUALITY OF SATELLITE-DERIVED DATA AND PRODUCTS

#### 3.1 Establish within GSICS a fully consistent calibration of relevant satellite instruments across CGMS agencies, recognising the importance of collaboration between operational and research CGMS agencies;

3.1.1 Establish a consistent inter-calibration for thermal IR channels using hyper-spectral sounders as reference. The implementation will be done successively by the individual satellite operators.



3.1.2 Establish a consistent inter-calibration for solar channels using instruments with adequate in-orbit calibration and vicarious methods as reference. The implementation will be done successively by the individual satellite operators.

#### 3.2 Establish commonality in the derivation of satellite products for global users where appropriate (e.g., through sharing of prototype algorithms);

3.2.1 Infer guidance from the ongoing intercomparison of AMV products for the future developments towards consistent AMV products. Consider in the guidance the future perspective of having the geostationary ring populated with 16-channel imagers.

3.2.2 Establish a coherent development of volcanic ash products (notably from current and future geostationary imagers) utilising the JMA testbed.

3.2.3 Develop best practices for retrieving cloud properties, using the converging capabilities of next-generation geostationary imagers

3.2.4 Using current and future geostationary imagers and sounders, generate and disseminate consistent basic nowcasting products, initially in pilot areas, as identified in SCOPE-Nowcasting.


3.2.5 To establish together with the user community a commonly agreed approach for retrieval of Principal Component scores and associated parameters from hyperspectral infrared data, minimizing information loss including the mutually acceptable update strategy for the principal component basis and to implement such an approach in a coordinated manner.



#### 3.3 Foster the continuous improvement of products through validation and inter-comparison through international working groups and SCOPE-type mechanisms;

3.3.1 Apply the IPWG validation protocol (as defined on its web page) to precipitation combination datasets generated using multiple satellite and in-situ data sources, and expand the number of participating agencies to broaden the validation domain

3.3.2 Increase the scientific and operational maturity of all SCOPE-CM phase 2 projects by 2015


3.3.3 Conduct an intercomparison study between the different methods to derive level 2 data from infrared hyperspectral sounders, recognising that there are several software packages available that utilize AIRS/IASI/CrIS data. 

**3.4 Harmonise the metadata (e.g. quality descriptors) and format of products to be exchanged, in adherence to the Service and Discovery metadata standards formulated in the context of WIGOS/WIS;**


3.4.1 Support WIGOS in the definition of harmonized product metadata for satellite data and implement for CGMS missions.

3.4.2 Promote the product metadata standards within ocean communities, such as on SST, ocean colour, ocean vector surface wind and ocean surface topography, to facilitate common data representation and near-real time exchange. This must be done in dialogue with the relevant CEOS Virtual Constellations.

**3.5 Maintain, enhance and improve the methods to describe the error characteristics of satellite data and products;**

3.5.1 Establish a common vocabulary and methodology with appropriate error propagation to include the errors associated with validation data (e.g. radiosonde temperature, water vapour, precipitation and winds). 

3.5.2 Address the error characteristics of wind products at the next International Winds Workshop in 2014 and provide a set of guidelines to be considered at the operational centres.

3.5.3 Agree on standardized procedures to derive NedT estimates for microwave sounders, and include such estimates in the disseminated BUFR data. 

**3.6 Strengthen interaction with users in selected thematic areas by establishing a close relation with them as beta-testers and foster optimum use of satellite data.**

3.6.1 Establish a sustained interaction with the operational Nowcasting communities with a view to fully utilise the commonality of the future geostationary imagers and sounders.

3.6.2 Report on the progress within the Nowcasting community toward the use of hyperspectral sounders and work toward common products to serve the requirements of the global community.

3.6.3 Enhance the use of satellite precipitation datasets through an IPWG-led user workshop where training on visualization and analysis tools will be one of the topics.

**3.7 Foster and support research regarding enhanced radiative transfer capabilities, recognising the paramount importance of radiative transfer developments for satellite products** 

3.7.1 Continue support for line-by-line (LBL) reference model development and enhanced characterization of spectroscopy to ensure that product development teams and users of level 1 data have access to the latest updates in LBL forward modeling and the uncertainties involved.

3.7.2 Perform validation and intercomparison of LBL models/spectroscopy to assess the impact of spectroscopic uncertainties and the differences between line-by-line and fast radiative transfer models.

3.7.3 Through coordination between IPWG, ITWG and ICWG, continue to improve microwave radiative transfer models to include complex surfaces (e.g., snow, desert, etc.) and scattering atmospheres (e.g., frozen hydrometeors) to support improved algorithm development for current and future sensors..

**3.8 Stimulate trade-off analyses for the development of future passive sounding instruments** 

3.8.1 Conduct studies to trade off benefits of spectral, radiometric, and spatial resolutions of infrared sounders considering the noise floor due to atmospheric noise and current uncertainties in spectroscopy enabling improved spatial resolution and increased number of field of views for next generation CrIS and IASI.

3.8.2 Conduct studies to investigate the technical feasibility to reduce the field of view sizes for future microwave sounders to keep in line with the spatial resolution expected for future global NWP models.



## **4 OUTREACH AND TRAINING**

### **4.1 Impact and benefit of EO satellite missions**

4.1.1 Develop and implement a credible methodology for assessing the socio-economic benefit of investment in EO satellite missions;

4.1.2 Engage in communication and outreach activities to promote EO benefits.

### **4.2 Training**



4.2.1 Continue to foster optimum use of satellite data for weather forecasting, climate applications, and environmental assessments including hazardous events such as volcanic ash and flooding;

4.2.2 Update and develop new VLab training material where necessary, and in collaboration with partner institutions such as Collaboration among Education and Training Programmes (COMET) and Committee on Space Research (COSPAR);

4.2.3 Provide shared, regular support to funding the VLab Technical Support Officer function through the WMO VLab Trust Fund, and to the VLab Centres of Excellence as per agreed expectations.

### **4.3 User Conferences**

4.3.1 Conduct regional satellite users conferences to (i) share experience and foster the exchange of ideas; ii) promote better access, and improve the utilisation of, existing satellite data and products; (iii) prepare the user community on new satellite systems' data products and services, (iv) engage young people entering the field and (v) other items as appropriate.

## 5 CROSS CUTTING ISSUES AND NEW CHALLENGES

### 5.1 Advancing the architecture for climate monitoring from space (through the joint CEOS-CGMS Working Group on Climate).

- 5.1.1 Establish first version of ECV Inventory
- 5.1.2 Establish initial ECV Gap Analysis
- 5.1.3 Define Action plan for delivering further Climate Data Records in response to initial gap analysis
- 5.1.4 Perform case studies linking CDRs to societal applications and informed policy decisions
- 5.1.5 Respond (via CEOS) to the GCOS IP and Satellite Supplement for submission (via GCOS) to COP-21
- 5.1.6 Report to UNFCCC Subsidiary Body for Scientific and Technological Advice-Research and Systematic Observation (SBSTA-RSO)
- 5.1.7 Assess the feasibility of incorporating in situ data holdings within the ECV inventory
- 5.1.8 Update ECV Inventory, Gap Analysis and Action Plan
- 5.1.9 Contribute to the Global Framework for Climate Services

### 5.2 Space Weather

- 5.2.1 Establish a coordinated approach to the monitoring of space weather and the reporting of space weather-related spacecraft anomalies;

### 5.3 Prepare operational users for new generation of meteorological satellites through user readiness programmes, with coordinated contributions from CGMS members in the areas of:

- 5.3.1 Sensor and signal characteristics;
- 5.3.2 Data dissemination and global data exchange,
- 5.3.3 Test datasets, processing and analysis tools, including methods for an efficient use of hyperspectral infrared data;
- 5.3.4 Products;

- 5.3.5 User training, including testbeds;
- 5.3.6 User involvement during the calibration/validation phase for new satellite data through general data access, in particular to NWP centres, to allow early feedback on data quality.
- 5.3.7 Provision of email-based user notification services that users can subscribe to, in order to receive alerts regarding advance notification of changes to data supplies, instrument anomalies including rough recovery schedules, etc.
- 5.3.8 Establishment of list of most relevant events affecting data quality, e.g., orbit manoeuvres, calibration changes, sensor anomalies, change of operation mode
- 5.3.9 Establishment of online status web-sites for their operational space-programs summarizing satellite, sensor, and processing status, including a searchable archive of status information, with key events (e.g., satellite/sensor failures, noise level out of specification, etc.) clearly separated from routine events.
- 5.3.10 Information on these topics should be synthesized and maintained by WMO in an multi-lingual online user guide, dynamically linked to resources of CGMS members, with an initial focus on the new generation of GEO satellites and with a view to extend to new LEO satellites;
- 5.3.11 Establish best-practices for the support of CGMS operators to User Readiness Projects, Taking into account the “guidelines for ensuring user readiness for new generation satellites” adopted at WMO EC-65.